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दूरनियत्रंण उपस्कर और तंत्र

भाग 1 सामान्य तथ्य

अनुभाग 2 विशिष्टियों की मार्गदर्शिका

Indian Standard

TELECONTROL EQUIPMENT AND SYSTEMS

PART 1 GENERAL CONSIDERATIONS

Section 2 Guide for Specifications

UDC 621·398

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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Power Line Carrier Systems and Associated Telecontrol Equipment Sectional Committee, LTD 25

NATIONAL FOREWORD

This Indian Standard which is identical with IEC Pub 870-1-2 (1989) 'Telecontrol equipment and systems — Part 1 : General considerations, Section 2 — Guide for specifications', issued by the International Electrotechnical Commission (IEC) was adopted by the Bureau of Indian Standards on the recommendation of the Power Line Carrier Systems and Associated Telecontrol Equipment Sectional Committee (LTD 25) and approval of the Electronics and Telecommunication Division Council.

The text of the IEC Pub has been approved as suitable for publication as Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

CROSS REFERENCES

In the adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards which are to be substituted in their place are listed below along with their degree of equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
IEC Pub 495 (1974) Recommended values for characteristic input and output quantities of single sideband power line carrier systems	IS 9482 : 1980 Characteristic values of inputs and outputs of single sideband PLC terminals	Technically equivalent
IEC Pub 870-1-1 (1988) Telecontrol equipment and systems — Part 1 : General considerations, Section 1 — General principles	IS 12746 (Part 1/Sec 1) : 1993 Telecontrol equipment and systems : Part 1 General considerations, Section 1 General principles	Technically equivalent
IEC Pub 870-2-1 (1987) Telecontrol equipment and systems — Part 2 : Operating conditions — Section 1 Environmental conditions and power supplies	IS 12746 (Part 2) : 1989 Telecontrol equipment and systems : Part 2 Environmental conditions and power supplies	Technically equivalent
IEC Pub 870-4 (1990) Telecontrol equipment and systems — Part 4 : Performance requirements	IS 12746 (Part 4) : 1993 Telecontrol equipment and systems : Part 4 Performance requirements	Identical

The concerned technical committee responsible for preparation of this standard has reviewed the provisions of the following international publications and has decided that they are acceptable for use in conjunction with this standard:

IEC Pub 870-3 (1989) Telecontrol equipment and systems — Part 3 : Interfaces (electrical characteristics)

IEC Pub 870-5 Telecontrol equipment and systems — Part 5 : Transmission protocols (being issued in various sections)

IEC Pub 870-6 Telecontrol equipment and systems — Part 6 : Telecontrol protocols compatible with ISO standard and CCITT recommendations

Only the English language text of the International Standard has been retained while adopting it in this Indian Standard.

IS 12746 (Part 1/Sec 2) : 1993
IEC Pub 870-1-2 (1989)

Indian Standard

TELECONTROL EQUIPMENT AND SYSTEMS

PART 1 GENERAL CONSIDERATIONS

Section 2 Guide for Specifications

INTRODUCTION

Planning of telecontrol systems and defining the specifications of a system and of its equipment are complex and demand a large amount of detailed information. There are not only application functions of the system to be defined but also the operational parameters, the local environmental conditions and the data transmission paths available as well as their characteristics. The interfaces between the components of the system and other equipment facilities such as power supply requirements shall also be specified.

Many aspects of this field are covered by standards within the IEC 870 series on telecontrol equipment and s,stems but many decisions are still left to the engineers who have to plan a system and establish the specifications.

1. Scope

This series of standards applies to telecontrol equipment and systems with coded bit serial data transmission for monitoring and control of geographically widespread processes.

2. Object

This section presents guidelines but not standards for establishing specifications for telecontrol systems and equipment following the other IEC standards on telecontrol systems and other relevant international standards and recommendations such as CCITT recommendations. It also facilitates the comparison of equipment of different manufacturers

The planning of telecontrol systems should be subdivided into clearly defined steps:

- The first step involves a consideration of the operational requirements of telecontrol systems (clause 3 of this sec
- In the second step, the conditions and limitations of the data transmission network are considered and the most suitable utilization is specified (clause 4 of this section)

- Thirdly, the required facilities for the telecontrol equipment and other equipment of telecontrol systems are specified. This includes considerations of whether it is useful to include existing local control equipment (clause 5 of this section).

The guidelines given in this section are applicable also if only parts of telecontrol systems are needed. In this case only the relevant clauses need be considered.

3. Description of the telecontrol system and its functions

Design aim of the system, for example:

- "Main (or regional) control system..." (name of the power company or of the region), or
- "District telecontrol system..." (name of the district itself or of the district control centre), or
- "Telecontrol system for power station..." (name of the controlled station).

3.1 *Description of the telecontrolled (or telemonitored) process*

3.1.1 *Purpose of process to be controlled*

(Short explanation only as far as necessary for planning telecontrol systems.)

3.1.2 *Name of master stations and control centres*

Description of the function, e.g. dispatching centre, regional control centre, etc.

3.1.3 *Number and names of outstations*

Description of their functions, e.g. "Power station...", "Transformer station...", etc.

3.1.4 *Geographical configuration of the system*

System block diagram and site description.

3.1.5 *Location and distances between interconnected stations*

3.2 *Functions of telecontrol systems*

3.2.1 *Survey of application functions*

3.2.1.1 *Basic functions*

- Telemetering of the transfer power flow, generated power, summation of the power consumption, line voltage, frequency, temperature, water-levels, etc.;
- telecounting of the generated energy, energy consumption, energy transfer, etc.;

- teleindication of the circuit-breaker, protection functions, alarms, etc;
- telecommand of the circuit-breaker, etc.;
- time synchronization between outstations and master station;
- time tagging of information.

3.2.1.2 *Extended processing functions*

- Teleregulation of the generated power (manually or automatically controlled);
- automatic power/frequency regulation;
- state estimation;
- automatic load shedding;
- switching programmes;
- operator interface (such as system operation, information display);
- information logging and reporting;
- data storage (short term/long term);
- etc.

3.2.2 *Requirements for operational parameters*

The following operational parameters are specified within Publication 870-4:

- reliability;
- availability;
- maintainability;
- security;
- data integrity;
- time parameters;
- accuracy.

In specifying the time parameters, particular consideration should be given to the:

- overall transfer time (sum of the times taken by the information passing through the individual sections of telecontrol systems, but also influenced by the network configuration, priority, accumulation of events, etc.);
- parameters for state information, such as separating capability, time resolution, suppression time, etc.;
- updating time for measured values and set point commands;
- etc.

It should be emphasized that in specifying the above-mentioned parameters the requirements of the process should be considered.

3.2.3 *Detailed specification*

The facilities required should be listed and briefly described

Below is a list of the standard facilities found in telecontrol systems.

3.2.3.1 *Input and acquisition of monitored information*

- Single point information;
  for alarms, state information, faulty state information, etc.
  (fleeting information or persistent information);
- double point information with or without acquisition of the intermediate state
  for circuit-breakers, isolators, etc
- integrated values
  for telecounting of energy values, etc.;
- incremental information
  for flow values, etc.;
- measured values (analog or digital) with cyclic or periodic transmission or transmission on demand
  for telemetering of electric values, hydraulic values, etc.;
- time tagging requirements;
- group alarms or common alarms derived from digital or analog information;
- information related to the telecontrol system itself, e.g. transmission error alarms, equipment failure alarms, etc.;
- other types of information.

3.2.3.2 *Output and presentation of information*

- State information;
- double point information with or without indicating the intermediate state;
- alarms, group alarms, common alarms;
- pulse output or persistent indication of integrated values;
- analog or digital display or measured values;
- information logging;
- data storage functions.

3.2.3.3 *Command input*

- Switching commands, single commands
  to change the state of an operational equipment in one direction
  (pulse commands or persistent commands);
- switching commands, double commands
  for circuit-breakers, isolators, etc.
  (pulse commands or maintained commands);

- set point commands
  values which are transmitted to the controlled equipment;
- adjusting commands
  for changing the state of operational equipment having more than two states;
- regulating commands (analog or digital)
  for closed loop telemonitoring and telecommand
  (regulating step commands or persistent regulating commands);

- select and execute commands;
- instruction commands
  for indicating a standard instruction to operators in the control room of a manually operated remote station,
  e.g. "Start generators";
- command sequences;
- group commands
  addressed to several items of equipment at an outstation;
- broadcast commands
  addressed to operational equipment at several or all outstations of a telecontrol system;
- commands related to the telecontrol system itself;
- interrogation commands;
- check commands
  e.g. for the purpose of ensuring that the telecontrol equipment is functioning correctly;
- other types of information.

3.2.3.4 *Command output*

- Single commands;
- double commands with or without supervision of faulty states;
- set point commands with or without validity indication and with or without storage;
- adjusting commands;
- command sequences;
- indication of the instruction commands.

3.3 *Data quantities*

The data quantities can be expressed by the number of input and output points. The number of points can be given in lists or tables, drawn up to reflect functions required as well as the different locations of telecontrol systems, for example:

Information input

Station / Input	a	b	.....	n	Totals
Single point information					
Double point information					
. . . .					
Other types of information					

Information output (per station)

Presentation / Output	Mimic diagram	Digital display	Analog display	...	Logging
State information					
Double point information (with intermediate state)					
. . . .					
Measured values					

Note – Initial and maximum capacities should be included where they are not the same.

Command input

Station / Input	a	b	.....	n	Totals
Single commands (pulse)					
Single commands (persistent)					
. . . .					
Other types of information					

Command output (per station)

Output mode / Output	Pulse output	Persistent output	.....	Analog output
Single commands				
Double commands (with check)				
. . . .				
Check commands				

Note - Initial and maximum capacities should be included where they are not the same.

3.4 *Man-machine interface*

The man-machine interface provides operators and maintenance personnel with appropriate reliable information on the actual status of the monitored process and the telecontrol system itself and offers facilities to control the process.

Below is a list of facilities of the man-machine interface:

- mimic diagram;
- operators' console;
- indicating instruments;
- visual display unit;
- recording equipment;
- acoustic indication;
- maintenance equipment.

3.5 *Characteristics of the data flow*

3.5.1 *Block diagram of the data flow*

A block diagram should show the types and quantities of information transmitted in the telecontrol system (see figure 1).

3.5.2 *Normal and disturbed conditions of the data flow*

3.5.2.1 *Order of the data flow* with respect to disturbances within the process system

a) Normal conditions (with a low rate of events per time unit).

b) Avalanche conditions (large number of events in one or more outstations).

3.5.2.2 *Changes of the data flow* due to other reasons

- Station initialization;
- transmission of integrated values after tariff change;
- transmission of some specific information on demand (after interrogation command);
- etc.

4. Specification of the data transmission network

4.1 *Data network configuration*

To be drawn up according to the different possible configurations as shown in Publication 870-1-1, Sub-clause 4.4, and according to the data flow of the planned telecontrol system mentioned in Sub-clause 3.5 of this section.

4.1.1 *Data link configuration*

Different configurations of links are possible:

- point-to-point;
- multipoint (e.g. multiple point-to-point configuration);
- composite (hybrid) configuration.

In configuring the data network, the following sub-clauses should be taken into account and the final solution should be presented in Sub-clause 5.3.

4.1.2 *Specification of the transmission speed of the different transmission channels*

According to the required transfer time which can be derived from Sub-clause 3.2.2 above.

4.1.3 *Specification of communication paths and media to be used by telecontrol system*

For all transmission links: e.g. PLC, fibre optic circuits, microwave or other radio channels, privately owned communication lines, rented data transmission channels or communication paths.

Coordination of the necessary telecontrol data transmission channels (refer to Sub-clause 5.1.2) to other telecommunication channels, e.g. telephone, teleprotection, etc., placed on the same communication path (separated by frequency multiplex or time multiplex).

4.1.4 *Specification of the characteristics of the chosen (telecontrol) transmission channels*

- Signal-to-noise ratio;
- bit error probability;
- probability of bit error bursts;
- availability of the channels.

4.1.5 *Data concentration*

Data reduction with respect to economic and useful data transmission at various points of a telecontrol network should be considered.

4.1.6 *Specification of redundant transmission channels*

According to the required availability. Back-up criteria are to be specified.

4.2 *Specification of telecontrol data transmission*

According to standard protocols (see Publications 870, Part 5), the following items should be specified:

4.2.1 *Specification of the transmission initiation mode*

- Cyclic or periodic transmission;
- transmission on demand;
- event-initiated transmission (spontaneous transmission);

- combinations of the above-mentioned initiation modes.

4.2.2 *Specification of required transmission link services*

With respect to the necessary data integrity and required transfer time:

- send/no reply;
- send/confirm;
- request/response;
- transmission priorities: correlation of the different types of data to the required priorities of transmission, according to the time requirements of the different application functions (see Publications 870, Parts 5 and 6).

4.2.3 *Types of traffic*

- Duplex
- Half duplex
- Simplex.

4.2.4 *Specification of data integrity requirements*

According to Publications 870-4, 870-5 and 870-6.

4.2.5 *Specification of data circuit terminating equipment*

CCITT recommends sets of standards, such as the V Series for analog transmission, and the X Series when digital transmission is employed.

The relevant characteristics concerning data integrity and transmission efficiency are: signalling rate, noise immunity and associated relations with respect to the signal-to-noise ratio, bit error probability and bit erasure probability.

4.3 *Representation of the planned data network in a block diagram*

Described in Sub-clause 3.5.1 above.

5. Equipment specifications

5.1 *Overview of the equipment of telecontrol systems*

Process equipment and operator's equipment;

- telecontrol equipment;

- data circuit terminating equipment (DCE);
- transmission channel equipment, e.g. PLC, microwave, etc.;
- power supply equipment.

5.1.1 *Provision of redundant equipment*

To fulfil required availability classes (see Publication 870-4).

5.1.2 *Analyses of existing equipment or systems*

It should be checked whether it is useful to include existing local control equipment in the telecontrol system, particularly with regard to the interface criteria (e.g. connections to local automation equipment by means of serial or parallel interfaces).

5.1.3 *Expandability*

Evaluation of the expandability (for further details, see Publication 870-4).

5.2 *Specifications of the environmental conditions*

The following conditions have to be considered (according to Publication 870-2):

- temperature, humidity and barometric pressure;
- mechanical influences;
- electromagnetic compatibility;
- corrosive and erosive influences;
- influences of the power supply;
- earthing and shielding.

These conditions should be specified for all locations and for each item of equipment:

a) within the apparatus room,
b) for equipment installed outdoors.

Important items to be considered are:

- process equipment such as sensors, transducers, actuators;
- wiring and shielding;
- transmission system, parts of existing links to be used and number of channels and their characteristics;
- existing power sources and their specifications.

5.3 *Specifications of interfaces between the different equipment of telecontrol systems*

In accordance with Publications 870-3 and 870-2 (for power supply only).

5.3.1 *Process equipment (at the outstation)*

a) Specification of the electrical interface criteria to the process (specification of barrier equipment for input of binary information and output of commands).

b) Specification of the interface conditions to the telecontrol equipment or checking and describing the interface facilities of existing process equipment.

c) Specification of the relations between input values (e.g. MW) and output values of the transducers (e.g. mA).

d) Specification of the power supply for the process equipment, barrier equipment, etc.

5.3.2 *Telecontrol equipment of the outstation*

a) Specification of the interface between telecontrol equipment and data circuit terminating equipment according to Publication 870-3 with, if necessary, supplements from CCITT recommendations.

b) Specification of the power supply of the telecontrol equipment in accordance with Publication 870-2-1.

5.3.3 *Data circuit terminating equipment (DCE)* (of outstation and master station)

a) Specification of the interface between the DCE and the transmission channel in accordance with Publication 870-3, and relevant standards of communication equipment, e.g. IEC Publication 495 for PLC transmission, CCITT recommendations for other transmission media.

b) Specification of the bandwidths and the different frequency allocations of the telecontrol data transmission channels.

c) Specification of the power supply of the DCE equipment, when the DCE is not an integral part of the telecontrol equipment.

5.3.4 *Telecontrol equipment at the master station* (and submaster station)

a) Specification of interface between telecontrol equipment and data circuit terminating equipment as described in 5.3.2*a)*.

b) Specification of the interface between operator's equipment and telecontrol equipment.

c) Specification of the interface between telecontrol equipment and process computers or other equipments in a higher hierarchical layer.

d) Specification of the power supply of the telecontrol equipment.

e) Specification of the power supply of the operator's equipment.

5.4 *Specifications of the power supply equipment*

According to Publication 870-2-1.

5.4.1 *Outstation*

a) A.C. or d.c. power supply (for power companies, d.c. supply from a dedicated battery is generally preferred in order to ensure operation of the telecontrol system during failures in the a.c. power system).

b) Specification of the nominal voltage.

c) Specification of the capacity of the battery, taking into account the power consumption of the system.

d) Conditions and requirements on earthing of the power supply.

e) Specification of maximum permissible duration of the interruption of the power supply, i.e. during changeover.

f) If the power supply battery also has to supply other equipment, e.g. telephone or local control equipment, possible interferences between the telecontrol system and the other systems shall be considered and limits specified exactly in accordance with Publication 870-2-1.

5.4.2 *Master station*

Usually uninterruptible a.c. power supply (UPS) maintains supply through an adequately large battery. Details required are:

a) specification of the nominal input voltages and their admissible tolerances;

b) specification of the admissible time of interruption of power supply to the UPS system;

c) specification of the power consumption;

d) specification of the capacity of the UPS battery.

5.5 *Mechanical specifications*

5.5.1 *Mechanical characteristics of equipment*

- Cabinet equipment
- Rack-mounted equipment
- Wall-mounted boxes.

5.5.2 *Space available for equipment installation*

Access requirements (front only or front and rear) should be specified.

5.5.3 *Other specifications for the installation of the whole system*

- Type of cable connection
- Marshalling racks
- Layout of cable channels
- etc.

5.6 *Specifications of transport conditions*

To check whether the specified classes for mechanical and atmospheric environmental conditions are appropriate for the transport of the equipment (by railway, post, ship, air-freight or special transport by truck). If not, special packing should be specified.

5.7 *System tests and commissioning procedures*

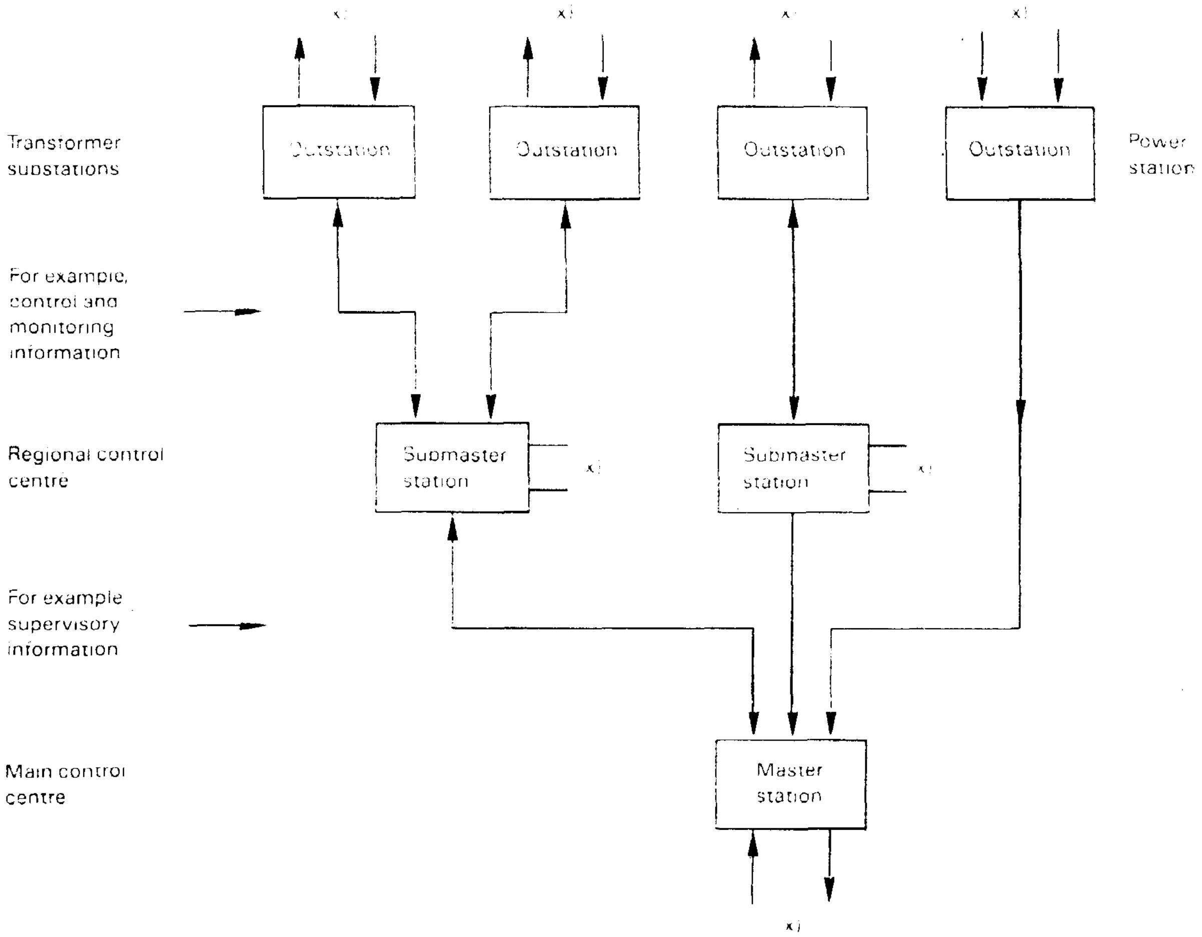
These shall be defined at an early stage.

5.8 *Operational conditions, guarantees*

Operational conditions for the beginning and termination of guarantees shall be agreed upon by purchaser and contractor.

5.9 *Documentation*

(Under consideration.)



x) Data types and quantities according to the tables in Sub-clause 3.3 (input/output)

Figure 1 - Block diagram of the data flow (example)

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